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PHYSIOGRAPHIC NOTES.

BY

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SHORELINE TOPOGRAPHY.—A consideration of shorelines from the standpoint of the American school of Physiography has for some time been needed. This Dr. Gulliver has attempted in his thesis for a doctorate at Harvard, recently published in the Proceedings of the American Academy of Arts and Sciences (Vol. XXXIV, 1890, 149-258). In this paper many facts concerning shorelines in various parts of the world have been brought together under several headings. There are also references to the individual coast charts upon which the phenomena described are to be seen illustrated. There is evidence in this of long, patient and detailed study of maps; and the appended bibliography, together with the references, furnish evidence of extended study of the literature.

While the paper must be considered as an important contribution to the literature of physical geography, it is weak in the fact that it is based upon laboratory rather than field work. Naturally an investigation of the shorelines of the world for a doctor's thesis could not be based entirely upon field study; but a large measure of field work might have formed a better basis for the map study. One naturally questions conclusions about far away places studied solely from maps. The necessity for a fuller knowledge of the field is evident from the failure of the author to recognize the importance of waves in modifying shore form, and in ascribing undue power to tidal and other currents.

The paper is in harmony with much American physiography literature in the use of unusual terms and the production of new terms. This is perhaps necessary, though if so, the necessity is to be deplored. Instead of deliberately offering a new term to be used, it should be the effort of every writer to avoid the coining of terms. In this paper, for instance, we find the following words, insequent, consequent, subsequent, obsequent and sequential, referring to land forms. To be sure the author of the paper is not the originator of these; but nevertheless he uses them. Are they necessary? Are they even useful? Then there are nips, loop-bars, flying-bars, rias, ria-deltas, tomboles, betrunken rivers, offsets,

overlaps (already in use in other meanings), cycles, epicycles, and winged beheadlands, the latter being a new name for Long Branch. Soon no one but a professional specialist in a single branch of physiography would be able to read the literature intelligently if this were allowed to go on and stand. The encouraging sign is that of the hundreds of names coined for land forms in the last fifteen years, only a few have been allowed to live.

LAKE IROQUOIS.—In connection with the discussion of the history of the Great Lakes published in the present and last numbers of this Bulletin, it is interesting to call attention to a recent paper by Coleman (Bull. Geol. Soc. Amer., March, 1899, Vol. X, 165-176). A part of this paper is devoted to a more or less theoretical consideration of the interglacial predecessors of Lake Iroquois and to a statement of the evidence of warping of the shore lines; but the most important portion is that which announces the discovery of fresh-water fossils in the beaches formed during the higher levels of Ontario in the vicinity of Toronto. In addition to shed horns of caribou and wapiti, and a mammoth's tooth, numerous shells of fresh-water forms were uncovered from beaches 150-160 feet above the present level of Ontario. This is not the first instance of such finds; but the prevailing absence of fresh-water forms has been one of the weak points in the theory that these higher levels were due to ice dams, and not to that incursion of the sea which made the marine beaches of the St. Lawrence valley. Each new discovery of fresh-water fossils in the lake beaches strengthens the already nearly established ice-dam theory.

GLACIATION IN THE UPPER YUKON.—One of the directions in which investigations in glacial geology are most needed is the study of the little-known regions of British North America, Alaska and Asia. When we know just how far the glaciers of these regions extend we may have better hopes of understanding their cause. Therefore a paper like that by Tyrrell (Bull. Geol. Soc. Amer., X, April, 1899, 193-198) upon the glacial phenomena of the Yukon, although brief and general, is of importance. While the Chilcat range is glaciated to-day, during a preceding period the glaciation of the region was much more extensive; but the high mountains even then projected above the ice fields which reached only to about latitude 62°. The characteristic feature of the glaciation was, as now, the development of valley glaciers, some of them reaching a depth of 2,000 to 3,000 feet. By their deposits numerous lakes

were formed, while beyond the limits of the glaciated region no lakes were seen.

The striking fact gained from this, as from preceding studies, is that, while the glaciers of the mountains of the northwest and of Asia were formerly more extensive than now, these sections were not at any time occupied by glaciers of continental proportions comparable with the great ice fields of the Atlantic basin in northeastern America, Greenland and northwestern Europe. This is a fact of marked significance in relation to the cause of the glacial period; but just what the significance is cannot now be definitely stated.

GLACIAL EROSION.—Some years ago Dr. D. F. Lincoln, and later the writer of these notes, brought forward evidence of profound glacial erosion in the Finger Lake region of New York, by which some of the grander features of the region have been produced. Since that time evidence in the same direction has been accumulated, though not yet published, which seems to place the conclusions of the previous papers beyond question. Studying in the same general region, Dr. Gilbert (Bull. Geol. Soc. Amer., X, March, 1899, 121-130) has arrived at the conclusion that the erosive work of the glaciers has been profound. Besides announcing his support to the general conclusions reached by Dr. Lincoln and myself, he brings forward evidence of marked glacial erosion along the south shore of Lake Ontario between the Niagara and Genesee valleys. He says: "From these facts it appears that if the drift were wholly removed and the rock surface bared the topography would comprise a series of ridges and troughs running parallel to the trend of the northeasterly streams. The details of rock configuration conform to the direction of ice motion, and are evidently products of glacial erosion."

VOLCANOES OF THE ABSAROKA RANGE.—Mr. Arnold Hague's presidential address before the Geological Society of Washington (published by the Society, Washington, April, 1899, and previously published in *Science*, 1899, XI, 425-442) is upon the early Tertiary volcanoes of the Absaroka Range, a region on the eastern side of the Yellowstone Park. The paper tells of the many eruptions, the evidence of marked sculpturing, the formation of lakes and ponds by the lava dams, the preservation of land fossils, and the evidence from various directions of great lapse of time occupied in the extrusion of the materials. This region of extensive and long-continued

volcanic activity naturally has an interesting story to tell, and many of the points brought forward by Mr. Hague will attract more than passing interest.

The one fact of most importance to the physiographer is the definite statement that, while there are true volcanic cones in the park, as for instance Mt. Sheridan, these are later than the Absarokas, and in the Absarokas "there is nothing to indicate the characteristic slopes of a great volcano." Dr. Thoroddsen has long since pointed out the evidence from Iceland that the eruptions there are from fissures, and that often no volcano has been built around the vent; and Geikie has pointed out the same for the ancient volcanoes of the British Isles. Now Hague affirms the same for the vast area of the Absarokas, and those who have given attention to the volcanic phenomena of the west are ready for the announcement and for similar conclusions from those who may study other great volcanic districts of the west. It seems certain that while tubular vents have had their importance exaggerated, fissures have not been recognized fully.

THE SHAPE OF THE EARTH.—Gregory (*Geographical Journal*, 1899, XIII, 225-251), after stating the well-known facts (1) that the land is mainly in one hemisphere and the water in the other, (2) that the oceans are triangular pointing northwards, while the continents are of the same form pointing southwards, and (3) that the continents are antipodal to oceans, discusses the explanations that have been proposed to account for this symmetry, and finds them wanting. He then restates Wm. Lowthian Green's tetrahedral theory and advocates it with great force and clearness, showing that the greater earth elevations and depressions are tetrahedral in arrangement, that geological evidence supports this view of earth form, since stable sections are located at the tetrahedral "coigns" or corners and unstable positions and lines of weakness along the tetrahedral edges, and that every hard-shelled spherical body which is diminishing in size, owing to internal contraction, tends constantly to become tetrahedral in form.

The case that he makes seems a strong one, and his paper appears to be one of the most rational attempts to state the law of earth form that has appeared. He remarks, as if to their discredit, that the elementary text books still teach that the earth is an oblate spheroid, although known not to be; but it may be said that in all probability they will continue to do so, for notwithstanding the fact that the earth is slightly deformed, it is still a sphere in its general

form, and young pupils who see it represented on a globe naturally understand it as a sphere. It would be unsafe and unwise in this connection, as in others, to attempt to teach them the whole truth. A geoid or a tetrahedral figure can mean little to them, and if an attempt is made to teach them what these terms mean, they will be led farther from the truth than they would be if taught that it is a slightly distorted sphere. Even when the tetrahedral theory is more firmly established than now its consideration must be postponed beyond the elementary books.